rtilizer & Pesticide Best Management Practices

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Sampling

For Point and Nonpoint Source Contamination Ground Water

Montana has long been known for clear, blue lakes and clean, rushing streams. But until recently little thought has been given to Montana's "buried treasure" — the abundant supply of ground water that most people rely on for drinking. Montana's high quality of ground water is also important to agriculture and to many of the state's leading industries. Unfortunately, people are more aware of ground water now because of increasing reports of its potential for contamination. Monitoring programs are under way to try to maintain high quality ground water. Trained professionals need to conduct the monitoring to make representative results and evaluate land use practices and their impact on ground water quality. Proper sampling takes time, money and expertise.

Point Source Sampling

Sites used for storage, mixing and loading of pesticides and fertilizers have a high potential for spills resulting in point source contamination. This is due to the amount of pesticides and fertilizers being handled, the transfer of pesticides and fertilizers between containers and equipment, accidents in storage areas, leaking from application equipment and residues from equipment washing and maintenance operation.

Sampling at these point source sites can meet a number of goals, some of which include:

- identification of chemicals involved in releases
- location of sources of point source impairment
- characterization of the horizontal and vertical extent of impairment in soil, ground water, surface water, and structures
- determination of the magnitude of residues in soil, water, and other media at a point source release

Initial Evaluation

An investigation at a point source site may require a two-phased approach consisting of an initial evaluation followed by more detailed sampling. Limited background information about sites, such as abandoned sites, may require that an initial evaluation be conducted to identify pesticides and fertilizers, to pinpoint areas of impairment, and to distinguish areas needing further sampling. Information from an initial evaluation will allow the investigator to plan more detailed sampling, to concentrate on heavily contaminated areas and provide the laboratory with information on the ranges of residue levels.

An initial evaluation may not be required in certain situations such as confined, well documented spills. The sampler may proceed with detailed sampling or combine an evaluation with the detailed sampling plan.

Background Information

The collection and analysis of background information about a point source site is essential for development of a sampling plan. Examples of background information include:

- ✓ the history of chemicals handled
- ✓ the types of operations performed
- ✓ the locations where chemicals were handled or operations performed
- ✓ a description of soil types
- ✓ ground water information including depth to ground water, regional flow direction, hydrogeology, and existing wells
- ✓ topography and surface runoff features
- ✓ a description of any spills, their locations, amounts, and the chemicals involved
- ✓ sensitive or critical areas where impairment could significantly affect human health or the environment
- ✓ a map of the site

The background information should also include the names and addresses of persons responsible for the site and their positions of authority.

Media Sampled

The types of media sampled at point source sites are generally limited to soil, ground and surface water, and occasionally wipe samples of hard surfaces. Residues in soil are important because they represent the cumulative impact of long-term use on a particular site with potential for leaching into underlying ground water. Residues in soils may also be an indicator of past point source problems at a site. Soil samples can be collected from:

- spill areas
- areas of visible impairment
- areas of dead vegetation
- high risk areas such as mixing and loading sites
- equipment parking areas
- surface runoff routes
- areas of surface water ponding
- storage areas

Soil should be collected from the surface and subsurface soil profile. Surface soil is usually sampled by taking composite samples. Composite samples are made of several subsamples from a defined area, usually within a uniform depth. Results show if the area is contaminated, which chemicals are present and whether further sampling should be conducted. Approximately three to six subsamples can be taken in an evenly spaced grid pattern from an area about 15 feet in diameter. Surface samples should be collected from the top six inches of soil, or in gravelly substrates, from the 12- to 18-inch layer.

Subsurface soil samples will provide information about chemical leaching. Subsurface samples should be collected in high risk areas in the same locations where surface samples were collected. The depth at which samples are collected will depend upon the goals of the investigation, soil conditions, the chemical(s) present and other site conditions. Generally, for initial investigations, samples can be collected from two to three feet and five to six feet below the soil surface. Samples are collected by trenching or using hollow stem augers designed to remove a core of soil from a desired depth. Soil borings should not penetrate into aquifers. After sampling, the bore holes should be filled in. Depending upon results, it may be necessary to sample deeper or at closer intervals.

Large rocks and debris should be removed from surface and subsurface soil samples and the samples should be screened with a 1/4-inch mesh screen. Samples can be collected in a previously unused quart canning jar with an aluminum foil seal placed between the jar and the cap.

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Jars should be filled approximately three-fourths full to allow for sample mixing by the analytical laboratory. All sampling equipment and containers should be washed with soap and water and then rinsed first with distilled water, then with acetone.

Ground water samples are usually collected down gradient from point source sites where there is a potential for ground water impairment. Some of the factors entering into the decision to sample ground water include the type of chemical(s) involved, soil types, depth to ground water and existing uses of ground water. Samples should be collected up gradient and down gradient of the point source. Existing domestic and livestock wells may be suitable for collection of samples, but it may be necessary to install monitoring wells for collection of additional samples. Each pesticide analytical method specifies sampling and preservation procedures. Therefore, the laboratory is consulted for assistance on sampling, preservation, shipping and documentation of samples. Analytical results will determine whether residues exist that present any hazards related to drinking water consumption, irrigation, livestock watering or other uses. If residues are present, further investigation may be needed to determine the extent of contaminant migration within the aquifer and to monitor residue levels.

Nonpoint Source Sampling

The Montana Water Quality Act gives the Montana Department of Health and Environmental Sciences Water Quality Bureau broad authority for control of nonpoint source contamination through application of "all reasonable land, soil and water conservation practices". These practices are meant to protect both present and reasonably anticipated beneficial uses.

The Montana Department of Agriculture and the Water Quality Bureau have been given authority by the Montana Agriculture Chemical Ground Water Protection Act to determine if pesticides and fertilizers are present in ground water. Both Departments may respond to agricultural complaints regarding agricultural chemicals and well sample requests from citizens who suspect their wells have agricultural chemical impairment. First, an investigator collects a water sample from the well in compliance with established Quality Assurance/Quality Control. The water sample is then sent to a laboratory to determine the presence of any pesticide or fertilizer. If the analysis reveals the presence of contaminants, follow-up samples are taken to verify the initial findings. Corroborating results will trigger further sampling in the vicinity of the original sample site to identify the source and extent of impairment. Monitoring is usually continued until tesidue levels fall below detection limits.

Sampling Scheme

Before sampling for nonpoint pollution from pesticides and fertilizers, a sampling scheme or plan should (as described under point source pollution) be developed. The predominant cropping practices and pesticide and fertilizer usage will dictate the type and quantity of samples that will be collected. Nonpoint implies the contaminant is suspected to have come from a large area and not from a localized source such as a spill. Once an area has been selected for further investigation, agencies often review existing databases for such information as previous sampling results, well-log data and kinds/amounts of ground water usage.

Agencies involved with nonpoint sampling/monitoring employ a variety of procedures to target areas from which to collect samples. Most often, a hierarchial approach is used as a means to identify vulnerable regions or sites. This consists of developing specific site descriptions which encompass such factors as soil type, depth to aquifer, ground water flow direction, cropping practices, pesticide use patterns or responding to public requests.

Sampling Plan

Once this information is obtained, a sampling plan can be developed. If the background investigation indicates that the agricultural chemical in question has been used in the area of concern, a radius of upgradient and downgradient wells from the contaminated well can then be sampled to determine the extent of the impairment and/or if migration of the impairment is occurring. If sampling indicates widespread impairment, the sampling radius can be increased until the extent of the impairment becomes known. If there are no wells available in the area which meet the sampling plan criteria (i.e., depth), monitoring wells may need to be installed to determine the extent and source of impairment. Soil samples from the area's surrounding fields where the agricultural contaminant was applied should be taken to determine levels of agrichemical residue present in the soil.

In recent years, statewide, county and regional aquifer vulnerability maps have been produced by various agencies to target areas which are known or suspected to be vulnerable to nonpoint source impairment. Ground water stored within shallow alluvial aquifers of Montana is susceptible to impairment from nonpoint sources. The shallow aquifers in these areas can be the source of drinking water for both rural and public water supplies. In many instances, intensified agricultural activities such as irrigation are being conducted over these shallow aquifers, which can assist in the downward migration of agricultural chemicals. Surface water along the valleys are also susceptible to impairment from agricultural chemicals from ground and surface water interaction, direct runoff and irrigation return flows and drains.

Permanent Monitoring Sites

The Montana Department of Agriculture has developed and implemented several types of nonpoint sampling activities of ground water for pesticides and fertilizers. Several permanent monitoring sites are located throughout the state in major crop production areas and sampled at least twice annually (spring and fall). Ongoing "general statewide" nonpoint sampling, initiated by the Montana Department of Agriculture in 1984, has identified several areas in the state where agricultural chemicals have leached into ground water. This sampling includes domestic, irrigation, livestock, public water supply and other individual(s) or agency(s) monitoring, or research wells. The Montana Department of Agriculture also develops and implements sampling plans for special projects where specific basins or watersheds are sampled.

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